DaimlerChrysler AG

Patent Claims

1. A method for stabilizing a vehicle combination (104) which is composed of a towing vehicle (101) and a trailer or semi-trailer (102), wherein the towing vehicle (101) has front wheels (103vl, 103vr) and rear wheels (103hl, 103hr), wherein at least one dynamic movement input variable (GIER_ROH) is determined and evaluated, wherein at least braking interventions for stabilizing the dynamic movement state of the vehicle combination (104) are brought about for the towing vehicle (101) if a rolling movement of the vehicle combination (104) is detected by means of the evaluation, characterized in that a yaw moment which counteracts the rolling movement of the vehicle combination (104) is produced solely by means of braking interventions which are brought about for the front wheels (103vl, 103vr) of the towing vehicle (101).

2. The method as claimed in claim 1, characterized in that braking interventions for the rear wheels (103hl, 103hr) of the towing vehicle (101) are additionally permitted or brought about only when a predefined operating state of the vehicle combination (104) is present.

3. The method as claimed in claim 2, characterized in that the predefined operating state of the vehicle combination (104), in which braking interventions for the rear wheels (103hl, 103hr) are permitted, is present if a rolling movement of the vehicle combination (104) is detected and at the same time there is no braking by the driver and the vehicle combination (104) is located on an underlying surface

with a low coefficient of friction.

4. The method as claimed in claim 2, characterized in that the predefined operating state of the vehicle combination (104), in which braking interventions for the rear wheels (103hl, 103hr) are brought about, is present if a rolling movement of the vehicle combination (104) is detected and at the same time there is no braking by the driver and the braking interventions which are brought about for the front wheels (103vl, 103vr) lead to a risk of the front wheels (103vl, 103vr) locking.

5. The method as claimed in claim 1, characterized in that braking interventions for the rear wheels (103hl, 103hr) are additionally permitted if a rolling movement of the vehicle combination (104) is detected and there is no braking by the driver and the vehicle combination (104) is located on an underlying surface with a low coefficient of friction.

6. The method as claimed in claim 1, characterized in that braking interventions for the rear wheels (103hl, 103hr) are additionally brought about if a rolling movement of the vehicle combination (104) is detected and there is no braking by the driver and the braking interventions which are brought about for the front wheels (103vl, 103vr) lead to a risk of the front wheels (103vl, 103vr) locking.

7. The method as claimed in claim 2, characterized in that the predefined operating state of the vehicle combination (104), in which braking interventions for the rear wheels (103hl, 103hr) are brought about, is present if the rolling movement is detected during a braking process which is initiated or carried out by the driver and the vehicle deceleration occurring as a result of the braking process which is initiated or

carried out by the driver fulfills a predefined comparative criterion.

8. The method as claimed in claim 1, characterized in that braking interventions for the rear wheels (103hl, 103hr) are additionally brought about if the rolling movement is detected during a braking process which is initiated or carried out by the driver and the vehicle deceleration occurring as a result of the braking process which is initiated or carried out by the driver fulfills a predefined comparative criterion.

9. The method as claimed in claim 7 or 8, characterized in that if the vehicle deceleration which occurs is below a predefined threshold value, the braking effect which occurs at the rear wheels (103hl, 103hr) as a result of the braking process which is initiated or carried out by the driver is at least partially reduced by the braking interventions which are brought about for the rear wheels (103hl, 103hr).

10. The method as claimed in claim 9, characterized in that the braking effect is reduced to such an extent that the value of the vehicle deceleration which has occurred as a result of the braking process which is initiated or carried out by the driver is at least maintained.

11. The method as claimed in claim 7 or 8, characterized in that if the vehicle deceleration which occurs is above a predefined threshold value, the braking effect which occurs at the rear wheels (103hl, 103hr) as a result of the braking process which is initiated or carried out by the driver is at least maintained by the braking interventions which are brought about for the rear wheels (103hl, 103hr).

12. The method as claimed in claim 11, characterized

in that if an intervention of an anti-lock brake system is made at one front wheel or both front wheels (103vl, 103vr), an additional braking effect is increased at the rear axle by the braking interventions which are brought about for the rear wheels (103hl, 103hr).

13. The method as claimed in claim 12, characterized in that the increase in the additional braking effect at the rear axle is carried out in such a way that the value of the vehicle deceleration which has occurred as a result of the braking process which is initiated or carried out by the driver is maintained.

14. The method as claimed in one of claims 3 to 8, characterized in that an essentially constant braking effect is achieved at the rear wheels (103hl, 103hr) by the braking interventions which are additionally permitted or brought about for the rear wheels (103hl, 103hr).

15. The method as claimed in claim 1, characterized in that the braking interventions which are brought about for the front wheels (103vl, 103vr) give rise to braking forces which are composed in each case of a basic force and a dynamic force component.

16. The method as claimed in claim 1, characterized in that at least the towing vehicle (101) is equipped with a hydraulic or electrohydraulic or pneumatic or electropneumatic brake system, wherein the braking interventions which are brought about for the front wheels (103vl, 103vr) lead to a situation in which in each case a brake pressure which is composed of a basic pressure and dynamic pressure peaks is fed into the wheel brake cylinders assigned to the front wheels (103vl, 103vr).

17. The method as claimed in claim 15 or 16,

characterized in that the yaw moment which counteracts the rolling movement of the vehicle combination (104) is produced by the dynamic force component or the dynamic pressure peaks.

18. The method as claimed in claim 15 or 16, characterized in that the value of the basic force or the value of the basic pressure is determined as a function of a deviation in the yaw angle rate, in particular the deviation results from the difference between the actual value (GIER_ROH) for the yaw angle rate which is determined using a yaw angle rate sensor and a setpoint value (Gier_Stat) for the yaw angle rate which is determined using a mathematical model.

19. The method as claimed in claim 15 or 16, characterized in that the value for the dynamic force component or the value for the dynamic pressure peaks is determined as a function of a variable which describes the change over time of a deviation in the yaw angle rate.

20. The method as claimed in claim 16, characterized in that both the basic pressure and the dynamic pressure peaks decrease as the rolling movement decreases.

21. The method as claimed in claim 1, characterized in that engine interventions are also carried out in addition to the braking interventions, wherein the moment which is output by the engine is set by means of these engine interventions in such a way that no circumferential forces, or circumferential forces which are near to zero, occur at the driven wheels of the towing vehicle.

22. The method as claimed in claim 1, characterized in that engine interventions are also carried out in

addition to the braking interventions, wherein the moment which is output by the engine is set by means of these engine interventions in such a way that the friction losses which occur in the drive train are compensated and the driven wheels are given a neutral setting as far as the circumferential force is concerned.

23. The method as claimed in claim 1, characterized in that after the stabilizing braking interventions have been initiated, it is checked whether the instability of the vehicle combination (104) decreases, wherein, when the vehicle combination (104) has reached a stable state again, no further stabilizing braking interventions are produced and at the same time the drive torque is set in accordance with the value which is predefined by the driver and which can be derived from the activation of the accelerator pedal.

24. The method as claimed in claim 1, characterized in that the braking interventions are carried out at the front wheels (103vl, 103vr) as a function of the value of the sensed yaw moment which acts in the vehicle and/or as a function of the value of the sensed yaw acceleration.

25. The method as claimed in claim 1, characterized in that at least the yaw angle rate (GIER_ROH) of the towing vehicle is determined and evaluated as a dynamic movement input variable.

26. The method as claimed in claim 1, characterized in that the speed of the vehicle (V), the yaw angle rate (GIER_ROH) and the steering angle (LW) are evaluated in order to determine whether a rolling movement is occurring.

27. The method as claimed in claim 1 or 26,

characterized in that a rolling movement is occurring if the yaw angle rate exhibits an oscillating behavior in an operating state of the vehicle combination (104) in which the speed of the vehicle (V) is higher than an associated threshold value, even though the driver is not making any steering interventions.

28. The method as claimed in claim 1, characterized in that the presence of a rolling movement of the vehicle combination (104) is detected as a function of a deviation variable (Delta_Gier_PID) which includes the deviation between the actual value (GIER_ROH) of the yaw angle rate and an associated setpoint value (Gier_Stat).

29. A device for stabilizing a vehicle combination (104) which is composed of a towing vehicle (101) and a trailer or semi-trailer (102), wherein the towing vehicle (101) has front wheels (103vl, 103vr) and rear wheels (103hl, 103hr), wherein the device comprises means (301, 401, 402, 901) for determining and evaluating at least one dynamic movement input variable, wherein the device also comprises means (302, 902) with which at least braking interventions for stabilizing the dynamic movement state of the vehicle combination are brought about for the towing vehicle if a rolling movement of the vehicle combination is detected by means of the evaluation, characterized in that a yaw moment which counteracts the rolling movement of the vehicle combination (104) is produced solely by means of the braking interventions which are brought about for the front wheels (103vl, 103vr) of the towing vehicle (101).